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February 1991

Stopping Accidents in

MAINTENANCE OPERATIONS



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A Message from the Commanding General of the U.S. Army Ordnance Center and School

Accidents during maintenance activities are an indication of operational weaknesses that, in combat, would quickly deplete our maintenance capability and affect readiness.

Maintenance, which keeps the troops on the move, is filled with risks. Eliminating or reducing those risks is a key part of carrying out the maintenance mission. The key to reducing risks to acceptable levels is training to standard and enforcing standards.

This pamphlet should help you evaluate and upgrade your safety efforts. It focuses on the leading causes of accidents in maintenance operations and provides general countermeasures for those accidents. It provides information on available safety resources and outlines risk management techniques that leaders can use to balance risks with operational requirements.

Questions concerning this pamphlet may be directed to CW4 Smith or SFC Hall, U.S. Army Safety Center, DSN 558-6595/3075, or Mr. Majewski, U.S. Army Ordnance Center and School, DSN 298-3418/3654.



**JOHNNIE E. WILSON
Brigadier General, USA
Commanding General
U.S. Army Ordnance Center and School**

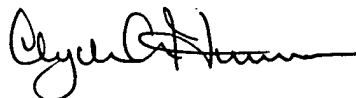
Foreword

Accidents and injuries in maintenance activities get little attention and often little in the way of prevention because, looked at individually, they often seem to be isolated "bad luck" events. But looked at collectively, these accidents and injuries represent a big loss to the Army.

On-duty personnel injuries accounted for 4,984 of the more than 9,911 Army accidents in one 12-month period, 31 of the 340 deaths, and \$46 million of the \$335 million total cost. Almost one out of five of the on-duty personnel injuries happened to people performing maintenance activities. Accidents during maintenance activities are second only to combat soldiering activities in producing on-duty injuries to soldiers and are the number one producer of on-duty injuries to civilians.

This pamphlet was based on research of maintenance accidents involving on-duty soldiers and civilians injured while installing, removing, or modifying equipment and focuses on the kinds of operational accidents that have the potential to rapidly deplete unit capabilities under combat conditions.

The Army Safety Center is interested in user reaction to this pamphlet. Your comments on its usefulness and suggestions for improving its content are welcome. Please use the pre-addressed mailer at the back of the pamphlet to let us hear from you.



C.A. HENNIES
Brigadier General, USA
Commanding General
U.S. Army Safety Center

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Section I

Risk Management

Risk management is the process of making operations safer without compromising the mission. Accident experience shows that mission-stopper accidents occur when victims are ignorant of hazards and countermeasures or when directed countermeasures are ignored. The greatest effort should be in hazard identification and countermeasure enforcement. This section provides leaders guidance on integrating the risk management approach into unit operations.

Rules

Three rules guide the risk management process:

Accept no unnecessary risks. The leader who has the authority to accept a risk has the responsibility to protect his soldiers from unnecessary risks. An unnecessary risk is one that, if eliminated, still allows mission accomplishment.

Make risk decisions at the proper level. Make risk decisions at a level consistent with the commander's guidance. The leader responsible for the mission should make the risk decisions.

Accept risks if benefits outweigh the costs. Leaders must take necessary risks to accomplish the mission. Leaders must understand that risk-taking requires a decision-making process that balances mission benefits with costs.

Process

There are five steps to the risk management process:

Identify risks. During mission analysis, identify specific risks associated with all specified and implied tasks. Determine the hazards causing these risks. Consideration of METT-T factors helps identify risks and is crucial to the second step of assessing risks.

Assess risks. Determine the magnitude of risks. This involves an estimate of loss cost and probability. The METT-T format provides an excellent guideline of factors to consider in this risk assessment. The *Enemy* equates to specific hazards identified. Consider the following aspects of other elements: *Mission* complexity and difficulty; *Terrain*, all aspects of the physical environment, including weather and visibility; *Troops*, supervision, experience, training, morale, endurance, and equipment; *Time* available for execution, planning, and preparation. Determine the likelihood and extent of accidental loss based on the above analysis.

Make decisions and develop controls. Make risk acceptance decisions by balancing risk benefits against risk assessments, and eliminate unnecessary risks. Reduce the magnitude of mission-essential risks through the application of controls. Controls range from hazard awareness to development of detailed operational procedures. Be sure controls **do not** jeopardize mission accomplishment. Involve the chain of command if necessary risks or controls prevent assigned mission requirements.

Implement controls. Integrate specific controls into plans, orders, SOPs, training performance standards, and rehearsals. Knowledge of controls down to the individual soldier is essential.

Supervise. Enforce controls and standards. This is key. Evaluate mission progress and changes to METT-T, then begin appropriate corrective actions. After mission completion, evaluate risk decisions and controls for inclusion in lessons learned.

Integration techniques

Two techniques are critical to maintaining unit battle focus:

Individual/leader risk management

(focuses on individual through company-level command thought processes to recognize hazards and take action to reduce risk). Use FM 22-100: Military Leadership problem solving, decision making, and planning process. Identify the problem (hazard), gather information, develop courses of action, analyze and compare actions, make a decision, make a plan, and implement the plan. Memory aids such as METT-T and checklists help promote consistency.

Command echelons risk management.

This technique uses the FM 101-5: Staff Organization and Operations Manual military

decision-making process. This process integrates safety and risk assessment into operational decisions normally associated with battalion and higher planning and operations. The commander directs the staff to identify necessary risks and risk controls as "considerations affecting the possible courses of action." Staff officers use memory aids such as METT-T to promote consistency. The final commander's estimate and concept addresses significant risk acceptance, eliminations, and controls. Implement these decisions directly into applicable areas of OPLANS (ORDERS). Commanders must ensure dissemination and enforcement of risk decisions and controls down to soldier level.

Section II

Maintenance Accident Causes

Most maintenance accidents are caused by:

- Failure to follow procedures.
- Poor supervision.
- Lack of written procedures.
- Insufficient or no training for the jobs assigned.

Failure to follow procedures

Shortcutting or disregarding established work procedures is the most frequent cause of accidents during installation, removal, and modification jobs. Mechanics may knowingly fail to use correct procedures because they are in a hurry to get the job done, because they do not understand the reasons for the work rules and the potential for injury, or because of a lack of supervision.

Using the wrong tools—lengths of pipe as extensions to increase leverage, screwdrivers as chisels, or hammers that are too heavy—is a common cause of maintenance accidents.

It's not enough to just write manuals and SOPs. They must be enforced. A "just get the job done and fast" attitude leads to taking shortcuts and accidents, injuries, and damaged equipment. It also produces a job that is neither "done" nor "fast." Many accidents happen when mechanics perform routine jobs that seem too simple to bother with safety precautions.

Actions to take:

Require strict compliance with safe work procedures no matter how routine the task.

Make sure all maintenance is done by the book.

Allow no shortcuts and watch for unsafe acts and violations of procedures.

Take prompt disciplinary action to correct violators.

Poor supervision

Frequently, supervisors do not fulfill their

responsibilities. They permit the use of unsafe or incorrect procedures, allow shortcuts, or fail to closely monitor personnel. Poor supervision is the result of command failure to take positive action when supervision breaks down.

All the written procedures in TMs and unit SOPs won't prevent a single accident unless the procedures are practiced. And they won't be practiced unless supervisors insist on it.

Never forget that supervisors must also be supervised.

Actions to take:

Hold supervisors accountable for their own unsafe actions as well as those of their subordinates.

Ensure personnel are properly trained, then demand they do the job right.

Require supervisors to—

—Set a good example of professionalism, competence, and safety discipline.

—Insist on compliance with established work procedures no matter how routine the job.

—Require the use of the right tool for every job.

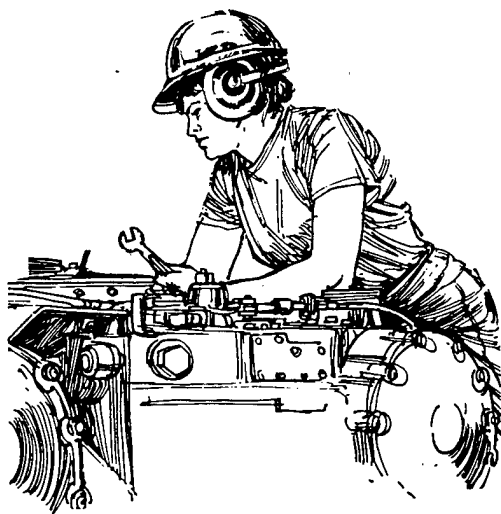
—Make sure protective equipment is available and worn.

—Use only qualified personnel for maintenance jobs.

—Set realistic time goals. Place more emphasis on safe, correct performance than on meeting work deadlines.

Lack of written procedures

Insufficient written procedures show up in poorly written standing operating procedures and in vehicle technical manuals. This lack consists mainly of absent or incomplete procedures for certain maintenance tasks. SOPs are not periodically reviewed to keep them current. Failure to submit DA Form 2028: Recommended Chan-



ges to Publications and Blank Forms permits deficiencies in technical manuals to go uncorrected.

Voids in written procedures in manuals can be remedied using DA Form 2028 to submit changes to publications. This is necessary if procedural steps are omitted.

Actions to take:

Ensure all personnel know how to complete DA Form 2028.

Supplement TM guidance with unit SOPs.

Use safety information in DA Pam 750-35 as sample for unit maintenance SOP.

Include requirements for personal protective equipment in SOPs.

Review SOPs regularly to ensure they contain specific guidance about the unit's maintenance tasks and ensure SOPs are updated periodically.

Pay special attention to use of tools and equipment, communication, lifting, security and inspection of components, hazardous actions, depressurizing, and housekeeping.

Spend time training and helping mechanics who may not have the experience or expertise to perform jobs safely without guidance.

Use the safety checklist available from the local safety office or the maintenance safety

checklist in DA Pam 385-1.

Insufficient or no unit training

Mechanics are often assigned jobs for which they either are not trained or have received insufficient training. This occurs when supervisors do not correctly assess training needs and develop and conduct training programs. Insufficient command emphasis on training increases this problem.

Actions to take:

Assess unit training needs.

Develop appropriate training programs.

Conduct these programs.

Hold refresher classes to update and strengthen training on maintenance tasks.

Conduct training on unit SOP requirements.

Have manuals and needed equipment and tools available.

Keep training performance oriented.

Make sure all supervisors and trainers take seriously their responsibility for teaching soldiers correct procedures and safe practices by setting the right example and consistently demonstrating professional standards of conduct.

Section III

Maintenance Problem Areas

1 Use of tools and equipment

Hand tools

Most technical manuals specify the correct tool(s) for the job. TM 9-243, the manual on the care and use of hand tools and measuring tools, contains excellent safety information. But it takes more than manuals to use hand tools safely. It takes:

- Training
- Supervision
- Self-discipline

Leaders train and supervisor their soldiers. Self-discipline results when a soldier knows how to do a job, knows the consequences of not following established procedures, and is motivated to perform safely.

The four most dangerous tools that cause injuries to mechanics are wrenches, hammers, pliers, and screwdrivers.

Actions to take:

Require strict adherence to correct procedures.

Ensure technical manuals are available and used.

Discuss safety of hand tools (use hip pocket safety sessions 1 and 2).

Personal protective equipment

Protective equipment—safety goggles, shoes, and helmets—can do its job only if it is used. Too often protective equipment is not worn because the mechanic is in a hurry, doesn't see the need to wear it, or doesn't know it should be worn. Supervisors often do not ensure the equipment is available, or they knowingly allow maintenance personnel to do their jobs without wearing it.

One of the keys to eliminating on-the-job injuries is correct and consistent use of personal

protective equipment. Some leaders consider minor on-the-job accidents as routine, everyday occurrences that are to be expected. But in units where the use of personal protective equipment is considered routine, accidents are not.

Actions to take:

Provide personal protective equipment (see AR 385-32, DA Pam 385-3, and CTA 50-900) and require it be worn.

Ensure equipment is readily available and clean.

Teach soldiers to regard personal protective equipment as tools of the trade, part of the job.

Discuss use of protective equipment (use hip pocket safety session 3).

Jacks, hoists, lifts

Mechanical aids are needed for moving or holding heavy objects. Incorrect use of lifting devices causes loads to shift or fall, usually resulting in injuries to the operator. Three common errors associated with lifting devices are:

Personnel do not use the correct jack, lift, or hoist for the job as specified in the appropriate vehicle technical manual.

The lifting device, when required, has not been load-tested before use in accordance with TB 43-0142.

The operator does not correctly inspect load security before and/or during the operation.

Most injuries are caused by failure to follow correct procedures.

Actions to take:

Ensure all authorized jacks, hoists, lifts, and appropriate manuals and operating instructions are on hand and used correctly.

Conduct unscheduled spot inspections to ensure compliance with safe operating techniques and procedures.

Require compliance with TB 43-0142 and TM 38-70 to test and mark all lifting devices, to ensure equipment serviceability, and to conduct daily inspections.

Hold personnel accountable for safe conduct on the job.

Reward safe performance and compliance with procedures.

Increase command emphasis on training, performance followup, and safety.

Discuss safe use of lifting devices (use hip pocket safety session 4).

2. Lifting

Personnel often lift repair parts, wheel assemblies, or other materiel incorrectly or fail to get help to do the job. Overexertion results in back, arm, and abdominal injuries. Shifting or falling parts and components cause face, hand, and leg injuries.

An estimated 20 percent of all maintenance injuries are caused by incorrect lifting. Leaders are responsible for reducing these injuries. DA Pam 385-8: Back Injury Prevention gives ways to prevent back injury.

Actions to take:

Eliminate as much manual lifting from the job as possible.

Require mechanical aids be used to minimize manual handling.

Require physical conditioning of personnel.

Conduct safe-lifting training.

Supervise lifting tasks.

Investigate back-injury accidents.

It is not enough for leaders to know how to prevent lifting injuries. They must motivate workers to accept their role in preventing such injuries. Do this through:

Awareness. Be sure workers know there is a

problem with back injuries and what they can do about it.

Information. Tell them the causes. Let them know how they can be affected.

Connection. Show them how routine jobs can lead to injuries. Show the cause-and-effect relationship of work to injuries.

Action. Teach and practice safe-lifting techniques.

Discuss safe-lifting techniques (use hip pocket safety sessions 5, 6, 7, and 8).

3. Hazardous actions

Mechanics often put themselves in wrong positions or use their hands or feet instead of mechanical help. Unstable and hazardous body positions and actions result in falls, back and limb injuries, fractures, and burns.

Strictly enforce maintenance techniques.

Routinely check that maintenance is "by the book."

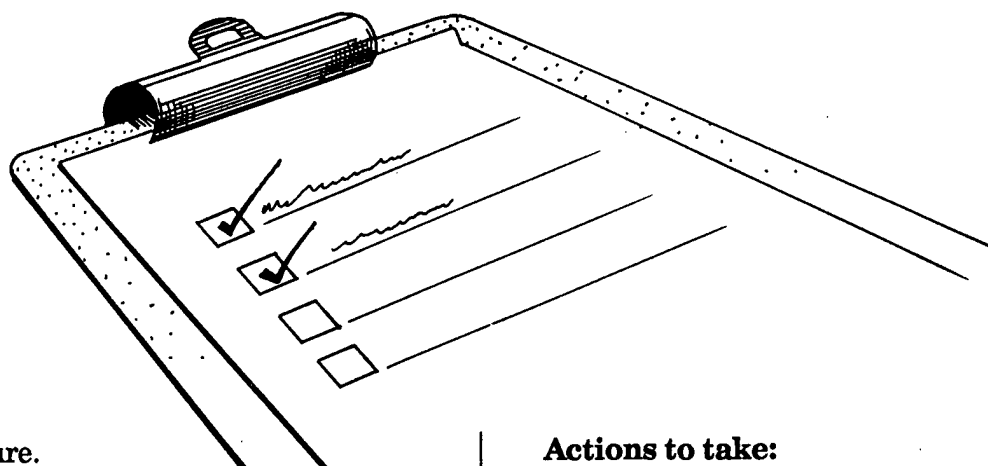
Establish procedures that make a supervisor responsible for any substitution of tools or equipment.

Give soldiers credit for their good ideas. If they come up with a better tool or way of doing a job, help them change the publication or put in a suggestion through the incentive awards program.

Discuss the hazards of mechanics putting themselves in the wrong position or of using their hands and feet for tools (use hip pocket safety session 9).

4. Security and inspection of equipment

Poor inspection of components, equipment, and work areas leads to hand injuries, burns, bruises, and falls. Mechanics often do not make sure components that have been repaired or in-



stalled are secure.

Actions to take:

Ensure your SOP spells out the exact standards required.

Have a checklist for setting up a maintenance job.

Establish a procedure to spotcheck completed jobs.

Instruct mechanics to look for potential hazards (use hip pocket safety session 10).

5. Lack of communication

Mechanics often do not warn coworkers when they start a vehicle or operate equipment, and they fail to tell others of inoperable components or equipment.

Maintenance activities often assign more than one soldier to a job, and such teamwork requires communication. Team members must communicate the intent of their actions as well as any hazards they discover.

Actions to take:

Establish "lock out" procedures or use "do not start" tags.

Evaluate the ability of the maintenance team to work together effectively.

Discuss the importance of communication with maintenance team (use hip pocket safety session 11).

6. Housekeeping

Mechanics often do not clear work areas before beginning work, they lay tools down and then stumble over them, and they try to hold slippery components. These work habits lead to injuries.

Good housekeeping is critical to preventing injuries in the maintenance shop.

Actions to take:

Ensure proper storage of flammables.

Allow time at the end of the day for cleanup.

Ensure supplies are available (rags for cleaning components, correct tools).

Designate storage places for tools.

Ensure mechanics have good tool habits (use hip pocket safety session 12).

7. Failure to depressurize or disconnect components/equipment

Maintenance jobs often involve systems that contain an energy source; e.g., hydraulic pressure, electrical energy, pressurized gas. These sources of energy have the potential for injury if not neutralized before maintenance.

Mechanics often do not release pressure on hydraulic fluid, or they do not disconnect battery terminals before performing maintenance on electrical systems.

Technical manuals are usually very clear where they provide the required before-work condition; e.g., turn turret power off before repairing turret.

Supervisors must make sure mechanics do not shortcut the procedures. If procedures don't exist, the unit SOP should contain the guidance and a publication change recommendation should be submitted.

Actions to take:

Release pressure before repairing items where escape of air, water, oil, hydraulic fluid, or other fluids may cause injury.

Remove the ground (negative-) battery cable before beginning repair work on components located in the engine compartment or on the electrical system (use hip pocket safety session 13).

Section IV

Vehicle and Equipment Problems in Maintenance Operations

Lack of driver training

Many times, soldiers are killed or injured simply because they lack the training to safely operate the vehicles they are required to maintain and, as is often the case, drive. Well-trained drivers can handle emergency situations caused by lack of steering response, braking power, and track loss without panic and with minimum loss.

Driver training requirements are outlined in AR 600-55, AR 385-55, FM 21-305, FM 21-306, and FM 21-17, as appropriate. Vehicles should not be operated even short distances without the correct training and licensing. *This includes maintenance personnel.*

To develop a driver training program:

Identify specific tasks, conditions, and standards that suit the mission and equipment.

Cover every facet—driver maintenance responsibilities, driving in all types of weather and over all types of terrain, and emergency procedures peculiar to each type of vehicle.

Establish specific standards a driver must accomplish before he is awarded a driver's license.

Whenever unit operations permit, pair an experienced driver with an inexperienced one to provide supervision and hands-on training.

Match the driver to the mission, and assign only the most experienced drivers to transport troops.

Allow only properly trained and licensed drivers to operate vehicles.

Special training is required for all aspects of recovery operations.

Speeding

Safe speed must always be determined by existing conditions (road surface, visibility, weather,

etc.), no matter what the posted speed may be.

Stress to senior occupants and track commanders that they are responsible for ensuring their vehicles are operated at speeds that are safe for existing conditions. Speeds that seem slow during normal conditions can be dangerously fast when visibility is limited or the road is slippery.

Establish safe speeds for various road and weather conditions, and enforce them.

Fatigue

People suffering from sleep loss go through various stages of fatigue, including decreased coordination, narrowed attention span, and reduced standard of performance. Any performance reduction from fatigue can be hazardous for vehicle drivers. Leaders must train themselves and their people to know the causes, signs, and results of fatigue and to be aware of its effects on their unit's ability to accomplish the mission safely.

Recognize the fact that as an exercise goes on, fatigue becomes more and more a factor.

Step up supervision to make sure safety precautions are not ignored.

Try to anticipate errors caused by fatigue, and take action to prevent them before they cause an accident.

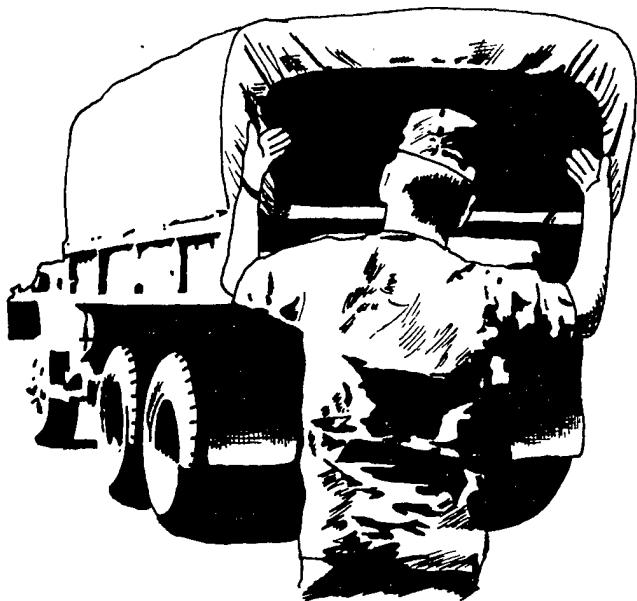
Use guidelines in AR 385-55 for establishing a rest policy for your unit.

Ensure guidelines for an established rest policy are included in the unit field SOP.

Following too closely

Following too closely is a frequent cause of vehicle collisions.

Make sure the unit SOP, in accordance with



appropriate TMs and FMs, clearly conveys convoy control and vehicle spacing.

Before each convoy operation, brief drivers on the safe-to-follow distance. Before establishing this distance, consider the type of vehicle and load, visibility and surface conditions, terrain, and weather. Faster speeds require greater distances between vehicles.

Ground guiding

Proper use of ground guides greatly reduces the chances of accidents in motor pools and other tight spots. However, improper use of ground guides greatly increases the chances of injury and death.

Ground guiding is serious business. A sound ground guiding policy can reduce accidents.

In any assembly area, before a vehicle is started, a member of the crew must walk completely around the vehicle to ensure nobody is

in danger from the vehicle's movement.

When tracked vehicles are moved within or through an assembly area, ground guides are required front and rear.

Wheeled vehicles will normally require one ground guide; however, two guides will be used when backing a wheeled vehicle with restricted vision.

Ground guides must stay clear of the vehicle and remain visible to the driver and each other at all times. They must maintain enough clearance to keep from being hit. If they must be in the path of travel they must stay a minimum of 10 yards from the vehicle. To avoid falling in the path of the vehicle, ground guides should walk on the side of the vehicle's path and never walk backwards.

Drivers are responsible for ensuring the ground guide's safety. Drivers should stop immediately if they lose sight of their ground guide.

Section V

Accident Prevention Planning

Leaders must take the initiative in making safety just as much a part of being a mechanic as troubleshooting vehicles. How can you do this in your unit?

Identify the problems. Find out what causes the most injuries in your unit. (You'll probably find the same ones that are discussed in the hip pocket safety sessions.) Do this by answering the following questions:

- What kinds of accidents happen in your unit?
- Where do they happen?
- To whom do they happen?
- How often do they happen?
- When do they happen?

Analyze the problems. Find the "why" behind the accident. For example, if a soldier is injured while using a lifting device, it's not enough just to blame the accident on his failure to inspect the device before use. You have to find out why he didn't inspect it. Ask yourself the following:

- Was the injured soldier trained in all unit SOPs?
- Were SOPs routinely enforced?
- Had the soldier received unit training in the task he was performing when he was injured?
- Were all MWOs checked for compliance?
- Was the appropriate device used?
- Was the device maintained IAW the appropriate TB or TM?

Were supervisory personnel monitoring the task and procedures?

Prevent the problems. Determine what you can do to prevent the problems. Here's a short list of ideas to get you started.

- Develop a procedure to ensure all personnel receive training on the contents of SOPs.

- Require supervisors to always enforce SOPs.

- Give additional unit training on nonroutine tasks.

- Cross-train mechanics according to Soldier's

Manuals and Job Books—not by the "buddy system."

Train mechanics to take care with tasks that have a higher hazard.

Follow up. Safe operations don't just happen. They result from careful planning. Develop your plan and put it to work. Then constantly analyze it. See how your mechanics respond to it. See if it reduces or gets rid of your safety problems. If it does, keep refining it to make it even more effective. If it doesn't, try a new plan. But in any case, remember—your safety plan should not be just temporary. Write it down and distribute copies to your NCO leadership. Keep it working.

Sample prevention plan

Problem. A maintenance company was losing a lot of work-hours to hand/finger injuries and back and abdominal strains. The mechanics were receiving these injuries during tactical exercises while changing large vehicle tires.

Analysis. Unit leaders found these accidents were caused by a combination of factors, not just one. Their analysis revealed that—

- The mechanics had a heavy workload.

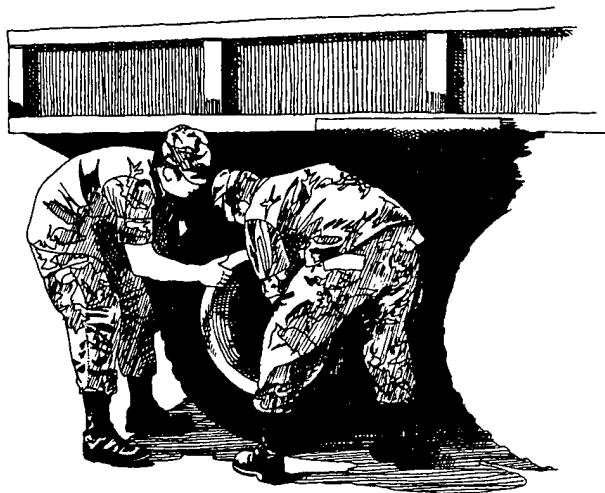
- Eleven mechanics had been in the unit less than 6 months.

- An unnecessary rush was placed on all maintenance practices while in a field environment.

Prevention plan. Unit leaders developed the following plan to solve the problem. The plan was to be given a trial during the next field exercise to see if it reduced mechanic injuries. If it did, it would be refined to improve results; if it didn't, a new plan would be developed.

- Increase training for mechanics on installation and removal of large vehicle tires.

- Train additional personnel (PLL clerks, TAMMS



clerks, administrative personnel) to assist in the installation/removal of large vehicle tires.

Prioritize field maintenance requirements to provide assistance to mechanics performing heavy lifting duties.

Conduct training on proper lifting techniques and require two or more personnel to lift large tires.

Provide safety equipment (gloves) to unit

personnel and require their use during all lifting.

Adopt a new approach to tactical training that stresses overall mission completion, not just the length of time it takes.

Present awards to the maintenance platoon with the greatest contribution to the mission. Selection will consider injury rates as well as tactical skill.

Section VI

Hip Pocket Safety Sessions

What are hip pocket safety sessions? Hip pocket safety sessions are any unscheduled instructions concerning a safety issue. A great time for them is during those inactive periods resulting from the old hurry-up-and-wait.

The use of this type training for maintenance personnel has obvious advantages:

It shows safe performance is one of the work standards.

It allows sharing of safety information about upcoming jobs.

It can be done with minimal planning during nonpeak work hours.

It shows supervisory support of safe activities.

It can be keyed to specific individuals or work groups without requiring entire unit participation.

It lends authenticity to the safety program by

keying on the job at hand and therefore avoids generalization.

It raises safety awareness level of personnel.

Implementation

Identify topics that are pertinent to the unit's maintenance activities (see list of additional hip pocket safety topics for recommendations).

Develop hip pocket safety sessions on selected topics.

Distribute hip pocket safety sessions to supervisors and discuss when and where they are to be used.

Have individuals from the command group or element occasionally conduct these sessions to reiterate and reinforce their concern for safety.

Continually revise and update the sessions to ensure applicability.

Hip Pocket Safety Session 1

Use of hand tools

Fact: Hand tools are the primary cause of maintenance injuries.

Safety points:

Use hand tools correctly and only for the job specified. Check the technical manuals. They tell you which tools to use for each job. Don't use a screwdriver on components held in your hand. Don't pull knives toward you. Don't use a sledgehammer when a nail hammer is needed. If you use a socket wrench that is too big, you'll round off the corners of the wrench or nut. In an emergency, you've made yourself a problem.

Keep each tool in its proper storage place. A tool is useless if you can't find it. The time it takes searching for a tool is wasted.

Keep your tools clean and in good condition. Keep them free of rust, nicks, burrs, grease, dirt, and breaks.

Never use damaged tools. A battered screwdriver can slip and spoil the screw slot or gouge the flesh out of your hand. A gauge

strained out of shape will result in inaccurate measurements.

Keep your tools within easy reach (but not where they can fall on the floor or in machinery). Don't place tools above machinery or electrical apparatus. A tool that falls into running machinery can cause lots of damage and injury.

Keep your tool set complete. When you're not using a tool, put it in the toolbox. Lock and store the box in a designated area. Keep an inventory list in the box and check it after each job. This will help you keep track of your tools. Replace missing tools after your mandatory inventory or, better yet, as soon as you find one missing or defective.

Look to TM 9-243 for proper hand tool usage. TM 9-243 contains information on hand tool safety, personal protective equipment, how to care for tools, and for what job each tool is designed.

Notes

Hip Pocket Safety Session 2

Hammers and things

Fact: Four common, everyday tools—hammers, wrenches, pliers, and screwdrivers—cause a majority of maintenance injuries.

Safety points:

Hammers. Hammers are often used instead of the correct tool, or the wrong type hammer is used. Using the wrong hammer for a job can cause it to bounce off the equipment and cause injury. Poor hammer strikes cause back strain, cuts, bruises, and hand or head fractures.

Never use a hammer with a loose head or a cracked handle.

Do not use the handle as a pry bar or to knock sharp edges together.

Inspect the faces of steel hammers for wear, dents, or chips.

Wear eye protection and watch the fingers.

Wrenches. Mechanics sometimes use the wrong size or type of wrench or socket for the job. Even when they have the correct wrench or socket, they sometimes use it incorrectly (e.g., tool is not properly seated or fitted, rusted or tightly torqued nuts or bolts are loosened incorrectly, unauthorized extensions are added to handles for additional leverage). Using the wrench or socket or using it incorrectly can result in its slipping or breaking, causing injuries. Overexertion can also cause strained torso muscles.

Fit the proper socket to nuts or bolts.

Never use "cheater bars" or extend handles in any way to increase leverage.

Apply penetrating oil to rusted nuts and/or bolts and allow time for it to penetrate.

Always pull wrenches.

Pliers. Pliers used as clamps can cause a load to fall and crush a finger. Mechanics sometimes use standard pliers for jobs that require brake-spring pliers, and the pliers slip or the brake spring recoils, causing an injury.

Do not use pliers as a clamp or vise.

Use the correct pliers for the job.

Screwdrivers. Screwdrivers are often used as levers, and metal chips and particles break off and hit the user in the eye.

Do not use screwdrivers for prying, punching, chiseling, scoring, or scraping.

Wipe grease and oil from handle before use.

Do not carry a screwdriver in your pocket unless it has a pocket clip.

Do not use screwdrivers near a live wire, to check a battery by arcing, or to determine if an electrical circuit is present.

Do not hold the item being worked on in one hand while using the screwdriver with the other.

Match the size of the screwdriver to the job and to the type of head on the screw.

Notes

Hip Pocket Safety Session 3

Using personal protective equipment

Fact: Personal protective equipment is required to protect soldiers from on-the-job hazards that can't be controlled. It must be worn to provide protection.

Safety points:

Eye protection. Flying objects (especially from hand tool use), abrasive sheets, corrosive substances (solvents, battery acid), light or heat rays (infrared, ultraviolet), and metal particles are causes of eye injuries in maintenance activities.

These hazards are always present during welding, cutting, soldering, chipping, grinding, and a variety of other operations. Wear welder's helmets, face shields, safety glasses, or goggles during these operations.

Welder's apron. When welding, always wear a leather welder's apron to prevent burns on the upper and lower torso of the body from flying sparks and welding slag.

Gloves. Hands are always getting hurt. Gloves will prevent many burns, cuts, blisters, and punctures. They'll also help you get a better grip on your job.

General purpose gloves are for lifting heavy items or for handling rough, scaly, or splintery objects.

Rubber gloves protect against acids, caustics, other chemicals, oils, and solvents. A specially designed rubber glove is used to protect against electric shock.

Asbestos gloves and mittens protect against sparks, radiant heat, or hot objects.

Ear protection. Hearing loss is the Army's No. 1 occupational health injury.

Equipment and power tools generate noise.

—M88A1 recovery vehicle (inside): approximately 95 decibels

—APC: approximately 115 decibels

—Air wrench: approximately 107 decibels

—Grinder: approximately 92 decibels

—Rivet gun: approximately 110 decibels

Any noise above 85 decibels is hazardous. Exposure to hazardous noise for 5 years without hearing protection will produce a hearing loss similar to the hearing loss of a normal 60-year-old individual.

Use proper hearing protection regularly.

Wearing hearing protection reduces fatigue.

Rule of thumb: If you can't carry on a normal conversation because of noise, use hearing protection.

Head protection. Helmet liners and hard hats provide on-the-job protection.

From falling or flying objects.

To protect head from bumps and bruises.

To prevent your head hitting electrical cables or power lines.

To prevent getting your hair caught in moving or rotating machinery.

To keep dirt and dust out of your hair.

Always wear head protection when riding in a tracked vehicle or when operating construction equipment.

Foot protection. Injuries to the foot are painful and may result in permanent disability. Safety shoes give protection.

Some safety shoes are designed to limit damage to toes from falling objects.

Some safety shoes are designed for use where danger from sparking could cause an explosion.

Respiratory protection. Maintenance tasks such as spray painting or asbestos brake removal may require use of a respirator. Different types of respirators should be used for protection against such hazards as dust, vapors, or lack of oxygen. For instance, in most cases,

an NBC mask will not provide enough protection for operations involving these hazards

and should not be used.

Notes

Hip Pocket Safety Session 4

Correct use of lifting devices

Fact: Incorrect use of lifting devices causes loads to shift and fall. Some maintenance personnel are not using jacks, hoists, and lifts correctly, are not load testing lifting devices, when required, before use, and are not inspecting load security before and during operation.

Safety points:

Jacks

Check the load capacity before using to make sure the jack can support the load. Inspect jacks before and after each use. Remove from service if hydraulic fluid leaks are found. Keep jacks well lubricated at the lubrication points specified. Do not throw or drop a jack on the floor.

Use on a level and clean surface. On an earth surface, set the jack on blocking that is at least twice the size of the jack. Level the blocking with shims. Use hardwood shims on the face of the jack to prevent metal-to-metal contact.

Never get under any load supported solely by a

hydraulic jack. Use jack stands when working under supported loads.

Chock the wheels of all vehicles, put the transmission in the gear recommended by the TM, and check the parking brake.

Hoists

Check the load capacity before using a hoist to make sure it can support the load.

Inspect before and after each use. Pay special attention to load hooks, ropes, brakes, and limit switches. Look for wear, malfunction, damage, and proper operation of clutches and limit switches.

Pick up a load only when it is directly under the hoist. Stay out from under raised loads. Use correct hand signals (FM 21-60). Do not lift, support, or otherwise transport people on hoists.

Make sure you know where everyone is before moving the load.

TB 43-0142. Use this bulletin, which prescribes safety inspection and load testing of lifting devices. It gives load ratings, current inspection date, and testing requirements.

Notes

Hip Pocket Safety Session 5

Move it safely

Fact: Too many maintenance workers lift and move parts and equipment wrong.

Safety points:

Correct lifting techniques could prevent many injuries. Here are some tips on how to lift the right way.

Plan the move. Get help with heavy or awkward objects. Check before lifting to be sure the path is large and free of hazards. Check the object to be sure it is free of anything that will make it slippery. Determine where it will be gripped.

Lift it. Crouch as closely as possible to the object. Get solid footing with feet 8 to 12 inches apart. Grip firmly, keeping fingers underneath

the load whenever possible. Keep arms straight and back as straight as possible, and use leg muscles to lift (this takes the strain off back muscles). Lift gradually, avoiding jerky motions.

Move it. Avoid twisting motions by shifting the feet. Keep a clear field of vision while carrying objects. Plan ahead on where to set the load if rests are needed. Don't reach over obstacles to reach loads or to place loads.

Put it down. Put things down by reversing the lifting methods. Bend knees while keeping the back straight and keep the load close to the body. Watch fingers and toes to avoid pinching them. Be sure the load is secure and that it won't fall, roll, tip, or otherwise create a hazard.

Notes

Hip Pocket Safety Session 6

Think ahead, then lift

Fact: Thinking before lifting can save a back or muscles from injury.

Safety points:

Analyze your task. How much does the load weigh? Is the pathway clear? Is equipment available to help lift the load?

Get help. If the load is too bulky or heavy, get help. Don't hesitate to ask someone for a hand—

a little help could save a lot of pain. There's nothing macho about lifting heavy loads and risking back injury.

Find a better way. Arrange for mechanical aids such as barrel tilters, hand trucks, jacks, and wheelbarrows.

Push, don't pull. You can push twice as much as you can pull, while running less risk of back strain.

Notes

Hip Pocket Safety Session 7

Tire removal the easy way

Fact: Removing and installing large tires on your own can be dangerous.

Safety points:

TM 9-2320-209-10-4: Maintenance, Operator Level, 2 1/2-ton, shows one person removing/installing large tires (over 31 inches in diameter). That's wrong. It takes two people. Changes to future manuals will show two people doing the job.

Trying to change those big tires alone can result in back, arm, and abdominal injuries due to overexertion. There is always the possibility of wheel components shifting or falling and crushing fingers and hands.

Some large vehicle tires weigh as much as 190 pounds. Take the time to evaluate what equipment and personnel are required and available to do the job safely.

If available, use (in accordance with the appropriate TM) a wheel lift truck to do the heavy work.

If a wheel truck is not available, use two or more people to lift the tire. Always remember to place fingers and hands so they will not be injured if the tire slips or falls.

Take the time to do the job safely and prevent the possibility of a disabling injury.

Notes

Hip Pocket Safety Session 8

Exercise to reduce back injuries

Fact: Back injuries account for one of every five maintenance accident injuries. Each year back injuries to military personnel cost the Army more than \$8 million.

Safety points:

Every time you lift, sit, stand, or even lie down, you are using your back.

The human back is a powerful, yet delicate machine. It needs care and maintenance

to keep it that way.

You can care for your back by:

- Using mechanical aids to lift.
- Thinking before lifting; getting help for large or heavy loads.
- Standing, sitting, and lying down with spine in balanced, neutral position.
- Exercising to gain back strength and flexibility.

Notes

Hip Pocket Safety Session 9

Body in danger

Fact: Mechanics have been injured by putting their bodies in dangerous places and by substituting their body parts for tools.

Safety points:

Cheater bars. Using your body for leverage instead of getting the correct tool—plumbing pipe instead of the proper length wrench—is asking for trouble. Get the right wrench or tool. Don't use cheater bars.

Alignment tools. Fingers put through a hole to check alignment get cut off. Use an alignment tool to be sure a bolt is aligned.

Human lifting device. Use the lifting device provided; don't be one. Using cinder blocks instead of jack stands can get you hurt.

Being a buffer. The soldier who gets between two vehicles or vehicle parts makes a poor buffer. Stand beside, not between.

Notes

Hip Pocket Safety Session 10

Inspect and be sure

Fact: Maintenance workers don't always secure loads or inspect components.

Safety points:

Inspection. Mechanics should look for potential hazards such as jagged edges, the need for special rust-removing lubrication, the proper fit of tools and components, and any special tools the job might require. Inspect the equipment and tools before the job to be sure they are in safe working order and have required inspections or tests. Be sure hand tools are checked in accordance with TM 9-243.

Premaintenance checks. Setting up to do the job is often as important as the job itself. Check the vehicle or piece of equipment to be maintained or used to be sure it has been properly prepared.

Are applicable TMs available?

Are tires chocked?

Is the parking brake set?

Is the transmission in part or neutral

(depending on TM)?

Are hoods/doors/hatches latched?

Are necessary conditions listed in the TM present?

Postmaintenance checks. Have a procedure for checking after the maintenance job is complete.

Check for loose components.

Account for all tools.

Ensure all tools are clean before storing or turning in.

Be sure all components are secure.

Tools. A place for everything and everything in its place is common sense in a maintenance facility. You cannot do an efficient, safe repair job if you have to stop and look around for each tool you need.

Keep tools within easy reach and where they cannot fall on the floor or into machinery.

Do not place tools above machinery or electrical apparatus.

Notes

Hip Pocket Safety Session 11

Talk to me

Fact: What is said is not always what is heard or meant. Lack of specific instructions makes for misunderstandings and results in injuries.

Safety points:

Be alert. Know where your coworkers are. Always give a "clear" warning and receive a response before starting or moving a vehicle. Also, an "all clear" is needed when aligning components.

Talk to others. Tell each other of dangerous situations you've encountered while working. If a component or tool is broken, let coworkers know. Don't let them be surprised and hurt.

Know plan of action. Make sure everyone knows who is doing what and where. Tell others what you are doing. Work together.

Pass the information. Keep everyone informed of problems, changes, requirements, and the meaning of the work terms to be used in work accomplishment.

Notes

Hip Pocket Safety Session 12

A place for everything

Fact: Mechanics sometimes do not clear the work area before beginning work. They lay tools down and then stumble over them, and they try to hold slippery components. These habits lead to injuries.

Safety points:

Keep it clean. This pertains to the work area, equipment, and tools.

Tool accountability. If you can't find it, it may be in a dangerous place—near the fan belt—and then it will bite back.

Wipe it up. Grease and oil have to be wiped up.

Be aware of flammables. All flammable waste materials should be removed to a collection area outside shops and garages. Gasoline is not a cleaning fluid, but it sure burns. So don't use it as a cleaning solvent.

Know safety equipment. Know where it is and what it is used for and how to use it, e.g., first aid kits, goggles, earplugs.

Keep it in place. Equipment and vehicles in a motor pool have their place; keep them in it. Don't block access routes.

Notes

Hip Pocket Safety Session 13

Decompress or disconnect, please!

Fact: Failure to disconnect wiring and pressurized components leads to equipment damage and personnel injury.

Safety points:

Fluid pressure. Release pressure before repairing items where escape of water, oil,

hydraulic, or other fluids is possible.

Air pressure. Release air pressure before demounting tires and servicing air brakes and compressors.

Electrical wiring. Disconnect battery cables and electrical wiring before working on components.

Notes

Hip Pocket Safety Session 14

Repair of split rim tires

Fact: Improper mounting or demounting of split rim tires can kill or cause serious injury.

Safety points:

Always use a safety cage to inflate tires mounted on rims with demountable side ring flanges or lock rings.

Never try to seat side ring flanges or lock rings during or after inflation. Improperly seated side ring flanges or lock rings could blow off.

Never overinflate any tire to seat tire beads.

There is only one approved way to inflate tires with side ring flanges or lock rings, and that is with an approved tire cage. Cages must conform to specifications in TM 9-2610-200-24 and TM 9-237. They must also be certified before use.

Use only tools designed for tire mounting and

demounting. Don't use pick-mattocks or sledgehammers for breaking down tires.

When in doubt on what to do, ask your supervisor for guidance before you continue.

Take a look at TM 9-243 for proper tool usage. It contains information on hand tool safety, personal protective equipment, and how to choose the right tool for the job.

Supervisor notes:

Use command facility engineers to certify construction of all inflation safety cages.

OSHA posters showing correct procedures should be displayed in all shops where mounting and demounting of split rim tires take place. Contact your local command safety office for information on obtaining these and other safety posters.

Notes

Additional Hip Pocket Safety Topics

Inspection of lifting devices in accordance with TB 43-0142

Submitting DA Form 2028 on TM

Submitting QDR/EIR on equipment and tools

Unit SOP requirements (DA Pam 750-35)

Use of tire cage for multi-rim tires

Necessity for inspection of components

Ignition lockout procedures

When and when not to improvise

Using TMs—how to get, use, change

Ground guides in and around motor pool, track park, and maintenance shop

Pre-job checks

Checking security of equipment on jack stands

After-job checklists

How to inspect tools

Section VII

Maintenance Safety Promotional Material

Pamphlets:

Safety Checklist: A ready safety reference encompassing most functions and tasks common to operations within a command.

Maintenance Safety Reader: A collection of articles from *Countermeasure* dealing with maintenance operations.

Hot Tips on Welding Safety: General hazards of all types of welding processes. Short safety briefings for welders.

Chemical Agent Resistant Coating (CARC Paint): General hazards and precautions concerning CARC paint, handling, storage, and application.

Primary and Secondary Battery Operations: Short safety briefings for equipment operators and personnel servicing batteries.

Spray Paint and Paint Booth Operations: General hazards concerning storage, handling, and application of paint products.

Radiator Repair: Accident prevention measures during radiator repair.

Conducting Brake Repair Operations: Accident prevention measures during brake repair.

For copies of the above pamphlets, write Commander, U.S. Army Safety Center: ATTN: CSSC-M, Fort Rucker, AL 36362-5363, or call DSN 558-2062.

Safety videos:

TVT 20-633, Maintenance Safety:
Discusses maintenance safety in and around

maintenance activities.

SF 20-689 and 20-690, Grinding Wheel Safety:
Stresses safety responsibilities when working with grinding wheels, such as safe wheel speeds, proper guards, static balancing, and checks and inspections.

TVT 20-440, Shop Safety or Putting the Odds in Your Favor: Five segments on the different aspects of shop operations and safety.

TVT 20-629, Eye Safety: Civilian-generated film concerning the same problems in civilian shops as those occurring in military shops.

TVT 20-628, Sound Advice: Civilian-generated video on hearing conservation.

TVT 20-660, Hearing Safety: Civilian-generated video relating to day-to-day duties.

TVT 20-632, Hear, Hear! Hearing Conservation for the Good Life: Civilian-generated video on hearing conservation.

TVT 20-781, The Back (Prevention of Back Injuries): Civilian-generated video relating to back injuries.

TVT 20-843, Go Ordnance . . . Go Safety: BG Ball gives talk on maintenance-related tasks and problems.

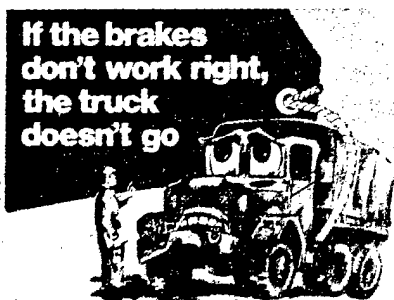
TVT 20-778, Supervising Safety: You Make the Difference: Civilian-generated video covering leader responsibilities and production results.

DA Pamphlet 25-90 contains a good selection of videos available through Department of the

Army. Your local Training Service Center (TSC) will have these videos or can order them for you. The Army Safety Center does not have videos to loan.

Posters

For copies of these posters, write Commander, U.S. Army Safety Center, ATTN: CSSC-M, Fort Rucker, AL 36362-5363, or call DSN 558-2062.



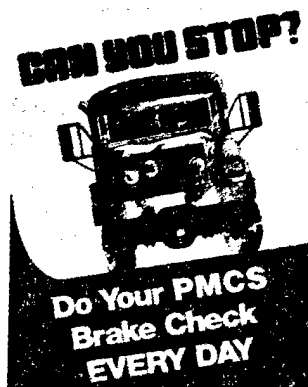
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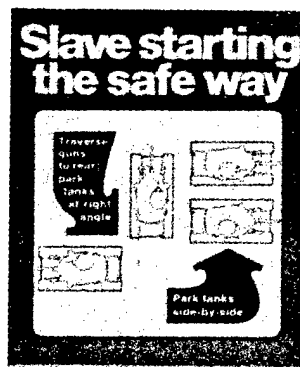
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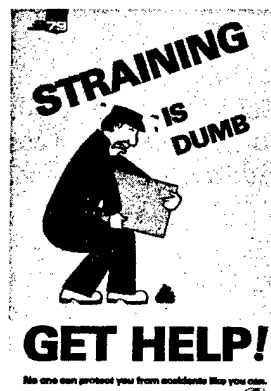
GET HELP!

No one can protect you from accidents like you can.

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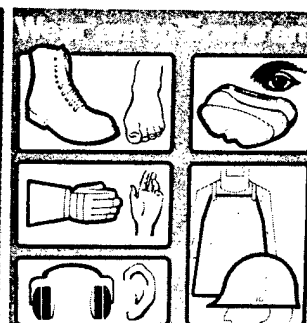
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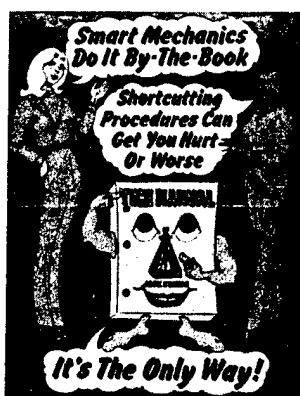
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Section VIII

Maintenance Leaders Checklist

Hand tools

Do personnel maintain tools in good condition, free of rust, nicks, and breaks?

Do personnel use hand tools correctly and only for the job specified?

Do personnel maintain a complete tool set?

Personal protective clothing and equipment (PPCE)

Do welders, painters, grinders, fuel handlers, maintenance workers, carpenters, metal workers, electricians, repairmen, warehousemen, etc. wear PPCE when involved in operations requiring the use of PPCE?

Are PPCE inspected and maintained in serviceable and sanitary conditions? Before reissuing, are they cleaned, inspected, and repaired?

Lifting devices

Are applicable lifting devices weight tested in accordance with TB 43-0142?

Are lifting devices inspected on a routine basis for wear and servicing?

Are operators familiar with and know the limits of lifting devices?

Brake and clutch repair

Are personnel familiar with asbestos warnings and precautions?

Are asbestos warning signs prominently displayed?

If vacuum cleaners are available, are they being used for cleanup?

Are proper respirators available for workers involved in brake and clutch repair?

Large tire removal/installation

If lifting devices are available, are they being used and are they in working condition?

If lifting devices are not available, are two personnel used?

Are safety equipment (gloves, safety shoes) and the proper lifting techniques (to avoid back strain) complied with?

Job area security

Are hoods in raised position and secure?

Are tires chocked, parking brakes set, transmission in neutral, etc.?

Are TMs available and the area maintained in a clean state?

This is not an all-inclusive list but is intended as a short mind-jogging list, to be used in conjunction with this pamphlet. A more extensive checklist can be found in the Safety Checklist referenced in Section VII of this pamphlet.

Section IX

Feedback

We are interested in your opinion of this maintenance pamphlet. Please answer the following and return promptly. A self-addressed mailer appears on the back of this sheet for your convenience.

1. How useful is this pamphlet to you? (circle one) Very Somewhat Not at all
2. Which section is most useful to you? _____

3. Which section is least useful to you? _____

4. What is your job title? _____

5. What is your pay grade? _____

6. Comments/recommendations: _____

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